Introduction

- The limited access to and high cost of 3He gas for MRI (Magnetic Resonance Imaging) has presented serious roadblocks for clinical translation.
- Another approach involves the use of hyperpolarized xenon-129 (129Xe) gas.
- The reproducibility of 129Xe measurements over short periods of time must be evaluated.

Research Objective

To evaluate the reproducibility of 129Xe MRI functional measurements within the same day (five-min rescan) and after a period of seven days in subjects with COPD (Chronic Obstructive Pulmonary Disease).

Methods

Study Subjects:
- Nine ex-smokers with a clinical diagnosis of COPD between the ages of 50-85.
- Three of these subjects returned for follow-up imaging seven days later for evaluation of reproducibility.

Image Acquisition:
- MRI was performed on a whole body 3.0 Tesla system (Discovery MR750 GEHC, Milwaukee, WI USA) with broadband imaging capability as previously described. 1H images were acquired prior to 129Xe imaging and were used to find the thoracic cavity volume.

Image Analysis:
- The images were evaluated by semi-automated segmentation of voxel intensities, as previously described. 129Xe MR images were segmented using a k-means clustering algorithm.
- 1H images were segmented using a seeded region growing algorithm to obtain the external contour of the thoracic cavity.

Statistical Analysis:
- A repeated measures analysis of variance was performed for statistical comparison of 129Xe ventilation cluster measurements (SPSS 19.0).

Results

Table 1. 129Xe MRI measurements at scan and 5-min rescan.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Scan (n=9)</th>
<th>5-min Rescan (n=9)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>VDP % (±SD)</td>
<td>26 (12)</td>
<td>26 (12)</td>
<td>0.80</td>
</tr>
<tr>
<td>C2 % (±SD)</td>
<td>17 (5)</td>
<td>16 (5)</td>
<td>0.20</td>
</tr>
<tr>
<td>C3 % (±SD)</td>
<td>20 (13)</td>
<td>24 (11)</td>
<td>0.14</td>
</tr>
<tr>
<td>C4 % (±SD)</td>
<td>24 (9)</td>
<td>23 (8)</td>
<td>0.14</td>
</tr>
<tr>
<td>C5 % (±SD)</td>
<td>12 (6)</td>
<td>11 (5)</td>
<td>0.08</td>
</tr>
</tbody>
</table>

Conclusions

- 129Xe MRI showed no significant difference in the gas distribution in the lung over short periods of time when no physiological change was expected to occur.
- Findings suggest that 129Xe is a highly reproducible noble gas and may be a feasible alternative to 3He MRI with strong translational potential in COPD studies.

References


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Contact: nkanhere@robarts.ca, gep@imaging.robarts.ca